CALIFORNIA OAK MORTALITY TASK FORCE REPORT
TO THE BOARD OF FORESTRY
MARCH 2015

MONITORING

2014 National *P. ramorum* Early Detection Survey of Forests Summary – Along the West Coast, California, Oregon, and Washington conducted stream surveys using bottle of bait (BOB) and/or leaf baiting. In CA, 146 sites were sampled over 5 baiting periods, with 19 positive samples collected (13 from previously positive locations). Six of the positives were from watersheds that had not previously tested positive (See the January COMTF report for more information.). In OR, 11 sites were sampled over 19 baiting periods, resulting in the detection of 6 positive waterways. The OR survey samples were tested via culturing and PCR, with PCR diagnostics identifying 10 samples that were not found through culturing. In WA, both BOB and leaf mesh bag sampling were used. The two positive samples found were with the bait bag sampling method (not BOB) and from the same stream.

Four of the 9 participating eastern states had 9 *P. ramorum*-positive stream samples - AL (4), FL (1), MS (2), and NC (2). Two of the positive streams (AL-1; FL-1) have not been previously positive and are each associated with a positive nursery. Another Alabama positive stream has not been previously positive but is not associated with a positive nursery. Plans for vegetation sampling near this stream are underway.

Bottle of bait (BOB – whole leaves and leaf pieces together in a bottle of collected water) monitoring protocols were adopted to detect *P. ramorum* for the forest stream survey in 2014. BOB whole leaves detected five positive streams and leaf pieces detected four. Nine environmental plant samples from Georgia were tested for *P. ramorum*, but all were negative. As found in previous years (2010-2013), the spring (March – May) bait period resulted in more positive samples (7) than the late season (October – November; 2). In total, 665 BOB samples were processed from 85 different sites in 9 eastern states (AL, FL, GA, MS, NC, NY, PA, SC, and TX).

Northern Olympic Peninsula, WA *Phytophthora ramorum* stream monitoring will be expanded in spring 2015 in an effort to identify the source of inoculum contaminating the Dungeness River near Sequim, WA. The river was found positive twice in 2013 and is not in the vicinity of a *P. ramorum*-positive nursery. To date, follow-up sampling of streams in the area have not yielded information about the inoculum source. The Chastagner lab at Washington State University, Puyallup will oversee the additional monitoring through a volunteer program and increase efforts to genotype isolates and DNA samples from waterways to help clarify the inoculum origin. Several stormwater retention ponds in Pierce County will also be monitored to determine if landscaped areas in new developments may harbor the pathogen.

England, Scotland, and Wales had a significant reduction in the number of new larch infestations in 2014. Aerial surveys detected approximately 123.5 acres of newly

infected larch outside of Scotland's southwest management zone, compared to 12,350 acres in 2013. About 1,482 acres were felled in public forests, with the private sector encouraged to take similar steps. In Wales outside the core disease zone, 52 new infestations covering 951 acres were identified, compared to 253 sites on 9,176 acres in 2013. In England, 334 suspect acres were identified for follow-up ground inspections (compared to 628 acres in 2013), resulting in the felling of approximately 618 acres of larch (as opposed to 1,976 acres in 2013). In southwest England, aerial surveys also found some localized death and dieback of *P. ramorum*-infested sweet chestnut trees (sporulating host) which are being felled for disease control. Low-level damage was also observed on non-sporulating hosts (Douglas-fir, Noble fir, and western hemlock) on sites where infected larch had previously been felled.

Most new infestations were close to known areas of infected larch or rhododendron. The decline in new infection is attributed to drier conditions and landowner cooperation with early detection and rapid felling of infested trees. To date, about 11 percent (43,225 acres) of Britain's larch woodlands have been felled or are due to be felled, leaving an estimated 337,155 acres with susceptible hosts not yet impacted by the pathogen.

FEATURED RESEARCH

Shrub tanoak is a *P. ramorum* host - In collaboration with UC Cooperative Extension-Humboldt/Del Norte, the UC Davis Rizzo lab has confirmed that shrub tanoak (*Notholithocarpus densiflorus* var. *echinoides*) is susceptible to *P. ramorum*. This host susceptibility trial was initiated after *P. ramorum* was confirmed in Trinity County in 2014 where shrub tanoak occurs more commonly than tanoak, *N. densiflorus* var. *densiflorus*. Studies to date have found no difference in lesion length between the varieties; however, the frequency of twig girdling lesions was lower for var. *echinoides* (shrub tanoak) than var. *densiflorus* (tanoak).

MANAGEMENT

A new management study focusing on preventing *P. ramorum* in coast live oak stands in the absence of bay is underway at Big Creek Reserve, Big Sur. The investigators, staff from the UC Davis Rizzo lab and Landel's Hill Big Creek Reserve, chose the site because it is dominated by large, mature coast live oak (*Quercus agrifolia*) trees with small bay trees in the understory.

Kerri Frangioso teaches a UC Santa Barbara ecology student to identify SOD symptoms on bay. Photo by: L. Wangdu, NRS.

Prior to bay removal, UC Davis researchers trained reserve employees and UC Santa Barbara ecology students on how to identify SOD/*P. ramorum* and sample symptomatic plants. One unit will have all bays removed and stumps treated with herbicide, while the other unit will remain untouched as a control. The

management site will be monitored annually to assure a bay-free environment is maintained.

Providing adequate resources are available, methodology employed here will be replicated in various Big Creek Reserve locations and the adjoining Packard property. For more information, contact Kerri Frangioso at kfrangioso@ucdavis.edu.

RESEARCH

Chen, G.; Metz, M.R.; Rizzo, D.M.; Dillon, W.W.; and Meentemeyer, R.K. 2015. Object-Based Assessment of Burn Severity in Diseased Forests Using High-Spatial and High-Spectral Resolution MASTER Airborne Imagery. ISPRS Journal of Photogrammetry and Remote Sensing 102: 38–47.

Partial abstract: Forest ecosystems are subject to a variety of disturbances with increasing intensities and frequencies, which may permanently change the trajectories of forest recovery and disrupt the ecosystem services provided by trees. Fire and invasive species, especially exotic disease-causing pathogens and insects, are examples of disturbances that together could pose major threats to forest health. This study examines the impacts of fire and exotic disease (sudden oak death) on forests, with an emphasis on the assessment of post-fire burn severity in a forest where trees have experienced three stages of disease progression prefire: early-stage (trees retaining dried foliage and fine twigs), middle-stage (trees losing fine crown fuels), and late-stage (trees falling down). The research was conducted by applying Geographic Object-Based Image Analysis (GEOBIA) to MASTER airborne images that were acquired immediately following the fire for rapid assessment and contained both high-spatial (4 m) and high-spectral (50 bands) resolutions.

Hansen, E.M. 2015. *Phytophthora* Species Emerging as Pathogens of Forest Trees. Current Forestry Reports. DOI: 10.1007/s40725-015-0007-7.

Abstract: Species of *Phytophthora* are prominent in lists of emerging threats to forest ecosystems. We explore the conditions leading to and the consequences of the emergence of some *Phytophthora* species from their presumptive coevolved roles in undisturbed forest ecosystems to destructive agents as invasive forest pathogens. *Phytophthora* species are widespread, relatively abundant, very diverse, and poorly understood in many relatively undisturbed forest ecosystems. Three examples are examined in detail to illustrate the range of pathways to emergence and the varied consequences to forest environments. *Phytophthora lateralis* causes Port-Orford cedar root disease in western North America and now Europe. *Phytophthora ramorum* is causing unprecedented mortality in oak and tanoak forests in California, as the cause of sudden oak death, and is killing planted larch in the UK, and *Phytophthora cinnamomi* kills trees in parts of the world where it has been introduced. Active programs are underway in each case to manage, if not eliminate, their damage. In no case, however, has eradication been achieved. Prevention, by blocking initial introduction, has the highest probability of success.

Kamoun, S.; Furzer, O.; Jones, J.D.G.; Judelson, H.S.; Ali, G.S.; Dalio, R.J.D.; Roy, S.G.; Schena, L.; Zambounis, A.; Panabières, F.; Cahill, D.; Ruocco, M.; Figueiredo, A.; Chen, X.-R.; Hulvey, J.; Stam, R.; Lamour, K.; Gijzen, M.; Tyler, B.M.; Grünwald, N.J.; Mukhtar, M.S.; Tomé, D.F.A.; Tör, M.; Van Den Ackerveken, G.; McDowell, J.; Daayf, F.; Fry, W.E.; Lindqvist-Kreuze, H.; Meijer, H.J.G.; Petre, B.; Ristaino, J.; Yoshida, K.; Birch, P.R.J.; and Govers, F. 2014. The Top 10 Oomycete Pathogens in Molecular Plant Pathology. Molecular Plant Pathology. DOI: 10.1111/mpp.12190.

Summary: Oomycetes form a deep lineage of eukaryotic organisms that includes a large number of plant pathogens which threaten natural and managed ecosystems. We undertook a survey to query the community for their ranking of plant-pathogenic oomycete species based on scientific and economic importance. In total, we received 263 votes from 62 scientists in 15 countries for a total of 33 species. The Top 10 species and their ranking are: (1) *Phytophthora infestans*; (2, tied) *Hyaloperonospora arabidopsidis*; (2, tied) *Phytophthora ramorum*; (4) *Phytophthora sojae*; (5) *Phytophthora capsici*; (6) *Plasmopara viticola*; (7) *Phytophthora cinnamomi*; (8, tied) *Phytophthora parasitica*; (8, tied) *Pythium ultimum*; and (10) *Albugo candida*. This article provides an introduction to these 10 taxa and a snapshot of current research. We hope that the list will serve as a benchmark for future trends in oomycete research.

Osterbauer, N.K.; Navarro, S.; Lane, S.; and Trippe, A. 2015. Assessing the Effect of Vernalization on the Detection of *Phytophthora ramorum* from Native Soil, Potting Media, and Cull Piles in Oregon Nurseries. Plant Health Progress. 16(1): 23-24. DOI: 10.1094/PHP-BR-14-0038.

Abstract: Nurseries in which *Phytophthora ramorum* is detected must undergo the USDA Confirmed Nursery Protocol (CNP) to eliminate the pathogen. The CNP requires a survey to determine the extent of the nursery's infestation, with samples tested immediately and after a required vernalization period. Previous research suggested this improves detection. Our objective was to determine if vernalization influenced pathogen recovery from native soil, potting media, and cull piles naturally exposed to *P. ramorum* in infested Oregon nurseries.

Roy, B.A.; Alexander, H.M.; Davidson, J.; Campbell, F.T.; Burdon, J.J.; Sniezko, R.; and Brasier, C. 2014. Increasing Forest Loss Worldwide from Invasive Pests Requires New Trade Regulations. Frontiers in Ecology and the Environment. 12(8): 457–465.

Abstract: Loss of forests due to non-native invasive pests (including insects, nematodes, and pathogens) is a global phenomenon with profound population, community, ecosystem, and economic impacts. We review the magnitude of pest-associated forest loss worldwide and discuss the major ecological and evolutionary causes and consequences of these invasions. After compiling and analyzing a dataset of pest invasions from 21 countries, we show that the number of forest pest invasions recorded for a given country has a significant positive relationship with trade (as indicated by gross domestic product) and is not associated with the amount of forested land within that

country. We recommend revisions to existing international protocols for preventing pest entry and proliferation, including prohibiting shipments of non-essential plants and plant products unless quarantined. Because invasions often originate from taxa that are scientifically described only after their introduction, current phytosanitary regulations – which target specific, already named organisms – are ineffective.

Schwenkbier, L.; Pollok, S.; König, S.; Urban, M.; Werres, S.; Cialla-May, D.; Weber, K.; and Popp, Jürgen. 2015. Towards On-Site Testing of *Phytophthora* Species. Analytical. Methods. 7: 211-217.

Abstract: Rapid detection and accurate identification of plant pathogens in the field is an ongoing challenge. In this study, we report for the first time on the development of a helicase-dependent isothermal amplification (HDA) in combination with on-chip hybridization for the detection of selected *Phytophthora* species. The HDA approach allows efficient amplification of the yeast GTP-binding protein (*Ypt*1) target gene region at one constant temperature in a miniaturized heating device. The assay's specificity was determined by on-chip DNA hybridization and subsequent silver nanoparticle deposition. The silver deposits serve as stable endpoint signals that enable the visual as well as the electrical readout. Our promising results point to the direction of a near future on-site application of the combined techniques for a reliable detection of *Phytophthora* species.

PHYTOPHTHORA TENTACULATA

A *Phytophthora tentaculata* Pest Alert is now available. To date, *P. tentaculata* has been found infecting plants at three restoration sites – one in Monterey County and two in Alameda County. It has not been found in the soil nor detected on adjacent native vegetation. At the sites, the pathogen has been found on sticky monkey flower (*Diplacus* [=*Mimulus*]) and toyon (*Heteromeles*). Treatment, monitoring, and safeguarding at each location is ongoing to prevent spread.

Phytophthora tentaculata has also been found in five native plant nurseries to date in Butte, Monterey, Placer, and Santa Cruz Cos. on sticky monkey flower (*Diplacus aurantiacus*), toyon (*Heteromeles arbutifolia*), coffeeberry (*Frangula californica*), and *Salvia mellifera*. All infected plants were destroyed. Nearly 500 samples have been analyzed from native plant nurseries (voluntarily) as well as from additional restoration sites to test for pathogen presence. In response to this situation, numerous native plant nurseries are now implementing best management practices, helping to insure that the best possible quality of plants are being grown. Surveys continue to determine if the pathogen occurs in undisturbed areas, particularly where the native plant nurseries have collected their propagative materials. These are the first detections of this *Phytophthora* in the US. For more information, contact Kathy Kosta, CDFA, at kathy.kosta@cdfa.ca.gov.

RELATED RESEARCH

Telfer, K.H.; Brurberg, M.B.; Haukeland, S.; Stensvand, A.; and Talgø, V. 2015. *Phytophthora* Survives the Digestive System of the Invasive Slug Arion Vulgaris. European Journal of Plant Pathology. DOI: 10.1007/s10658-015-0597-8.

MEETINGS

The annual North Coast Sudden Oak Death Coordination Meeting will be held on Thursday, April 23, 2015 at the Fortuna River Lodge in Fortuna. Convened by UC Cooperative Extension, Humboldt and Del Norte Counties, the goal of the meeting is to provide forest managers, natural resource professionals, and interested public with the latest updates on pathogen activity, monitoring, and management in the North Coast and southern Oregon. New this year will be a special segment on tanoak that will feature trends in North Coast tanoak population genetics as well as an update on tanoak resistance trials currently being conducted in the region. For more information, see the Calendar of Events below.

PERSONNEL

Bruce Moltzan, USDA FS FHP National Pathologist in Washington D.C., is the new lead for the USDA Forest Service National *P. ramorum* Early Detection Survey of Forests. He will be responsible for coordinating funding and survey protocols for the national FS *P. ramorum*/SOD stream surveys. He can be reached at bmoltzan@fs.fed.us.

CALENDAR

3/6 – Trinity County SOD Blitz Training; Weaverville Fire Hall; 125 Bremer Street, Weaverville; 6:00 – 8:00 p.m. For more information, contact Ryan De Santis at rdesantis@ucanr.edu.

3/24 – 3/26 – Meeting of the 61st Annual Conference on Soilborne Plant Pathogens (formerly Soil Fungus Conference) and the 47th Annual California Nematology Workgroup; UC Riverside; For more information, or to register, go to http://soilfungus.wsu.edu/.

4/10 – Santa Cruz SOD Blitz Training; UC Santa Cruz Botanic Garden; 6:00 – 8:00 p.m.; For more information, contact Brett Hall at brett@ucsc.edu.

4/11 – East Bay (Orinda) SOD Blitz Training; Orinda Library Garden Room; 26 Orinda Way, Orinda; 10:00 a.m. – 12:00 noon; For more information, contact Bill Hudson at wllhh@ymail.com.

4/11 – East Bay (Berkeley) SOD Blitz Training; UC Berkeley campus; 159 Mulford Hall, Berkeley; 1:30 p.m. – 3:30 p.m.; For more information, contact Garber Park at garberparkstewards@gmail.com or Sausal Creek at coordinator@sausalcreek.org.

4/18 – Napa SOD Blitz Training; UC Cooperative Extension Office Meeting Room; 1710 Soscol Avenue, Napa; 10:00 a.m. – 12:00 noon; For more information, contact Bill Pramuk at info@billpramuk.com.

4/23 – Annual North Coast Sudden Oak Death Coordination Meeting; Fortuna River Lodge; 1800 Riverwalk Dr., Fortuna; Pre-registration is required by April 20th. A $15 registration fee covers lunch and materials. To register, go to

http://ucanr.edu/northcoastsodmeeting. For more information, contact Dan Stark at (707) 445-7351.

4/25 – Montalvo SOD Blitz Training; Montalvo Art Center, The Art Commons; 15400 Montalvo Rd., Saratoga; 10:00 a.m. – 12:00 noon; For more information, contact Ann Northrup at annnorthrup@sbcglobal.net.

4/25 – South Skyline SOD Blitz Training; Cal Fire Saratoga Summit Fire Station 21; 12900 Skyline Blvd, Los Gatos; 1:00 – 3:00 p.m. For more information, contact Jane Manning at skyline_sod@yahoo.com.

5/2 – Burlingame SOD Blitz Training; Burlingame Hills; 120 Tiptoe Lane (off Canyon Rd.), Burlingame; 10:00 a.m. – 12:00 noon; For more information, contact Steve Epstein at steve@burlingamehills.org.

5/2 – Los Altos Hills SOD Blitz Training; Los Altos Hills Town Hall Council Chambers; 26379 Fremont Rd, Los Altos Hills; 1:00 – 3:00 p.m.; For more information, contact Sue Welch at sodblitz09@earthlink.net.

5/8 – North Coast SOD Blitz Training (Fort Bragg); Location to be determined; 6:00 – 8:00 p.m. For more information, contact Nancy Ruth Morin at Nancy.Morin@nau.edu.

5/9 – North Coast SOD Blitz Training (Point Arena); Location to be determined; 10:00 a.m. – 12:00 noon; For more information, contact Nancy Ruth Morin at Nancy.Morin@nau.edu.

5/15 – San Luis Obispo SOD Blitz Training; San Luis Obispo UC Cooperative Extension classroom; 2156 Sierra Way, San Luis Obispo; 6:00 – 8:00 p.m.; For more information, contact Lauren Brown at lbrown805@charter.net.

5/16 – Woodside, **Portola Valley, Atherton, Emerald Hills, and Belmon**t **SOD Blitz** Training; Woodside Town Hall; 2955 Woodside Rd.; Woodside; 10:00 a.m. – 12:00 p.m.; For more information, contact Debbie Mendelson at naturemend@sbcglobal.net.

5/23 – Carmel Valley SOD Blitz Training; Carmel Valley Garland Ranch Regional Park Museum Hall; 700 West Carmel Valley Road, Carmel; 10:00 a.m. – 12:00 noon; For more information, contact Kerri Frangioso at kfrangioso@ucdavis.edu.

5/30 – Marin SOD Blitz Training; Dominican University of California; Joseph R Fink Science Center, Rm 103, San Rafael; 10:00 a.m. – 12:00 noon; For more information, contact Wolfgang Schweigkofler at wolfgang.schweigkofler@dominican.edu.

5/30 – Sonoma SOD Blitz Training; 5 Locations to be determined; 10:00 a.m. – 12:00 noon; For more information, contact Lisa Bell at Lisa Bell lkbell@ucanr.edu.

8/23 – 8/28 - 5th International Workshop on the Genetics of Tree-Parasite Interactions; Orléans, France; For more information, or to register, go to https://colloque.inra.fr/tree-parasite-interactions2015.